

DRAFT

USING PHOTOCHEMICAL REACTIVITY AS A VOLATILE ORGANIC COMPOUND CONTROL STRATEGY FOR AEROSOL COATINGS

As a voluntary compliance option for aerosol coatings, we are proposing an alternative to the mass based volatile organic compound (VOC) limits. This is a new reactivity-based regulation, the California Low Emissions and Reactivity (CLEAR) Regulation for Aerosol Coatings. The proposed regulation is intended to provide flexibility to manufacturers by allowing them to choose to comply with either the mass-based or the reactivity-based VOC limits. The proposed limits will achieve equivalent ozone reductions, but allows manufacturers to choose the least costly approach to compliance. Our goals through the CLEAR Regulation are to provide compliance flexibility and to effectively reduce ozone by targeting reductions in the VOCs that have a higher potential to form ozone.

1. Appropriateness of the Maximum Incremental Reactivity (MIR) Scale for Use in the CLEAR Regulation

For ozone control strategies, the reactivity scale selected should be designed for the best overall air quality benefit. If the conditions are NO_x-limited (such as the Southeastern United States), then NO_x controls are the most appropriate strategy. In NO_x-rich urban areas, such as the South Coast Air Basin, VOC along with NO_x control, is the best approach to control ozone-formation at the ground-level. Because the MIR scale simulates conditions of NO_x-rich scenarios, which are optimal for the production of ozone, the MIR scale is useful for VOC control strategies in California.

Dr. Carter has studied 18 different ways of ranking the reactivity of individual VOCs in the atmosphere using a single-cell trajectory model with the SAPRC90 chemical mechanism (JAWMA, 1994). Of the 18 scales developed by Dr. Carter, he concludes that if only one scale is to be used for regulatory purposes, the MIR scale is the most appropriate. This scale is optimal when applied to a wide variety of conditions where ozone formation is sensitive to VOCs, such as in the South Coast Air Basin, and also most appropriate when reducing the exposure of integrated ozone. For these reasons, in this proposed CLEAR regulation, we are proposing to use the MIR scale.

The most current chemical mechanism is SAPRC98. The MIR scale derived from this mechanism was developed using a set of 39 Empirical Kinetic Modeling Approach (EKMA) model scenarios with different initial VOC/NO_x ratios. The MIR scale is based on the average conditions of these 39 scenarios, of which four California metropolitan areas are represented. They are Los Angeles, Sacramento, San Diego, and San Francisco. It is also from these 39 scenarios in which the base case ROG mixture used for the MIR scale is obtained.

However, as with any reactivity scale derived from predictive models, including the MIR scale, there are uncertainties associated with them. The majority of the uncertainty arises from the experimental data and the uncertainty of the chemical mechanistic reactivity. However, the MIR scale is robust for the inclusion of the data accounting for the VOCs' impacts on ozone levels. These uncertainties should not preclude regulatory development, however. Within the regulation, adjustment factors are used to modify the estimated MIR value for VOCs to account for the degree of uncertainty associated with the VOC. We also recognize that numerous VOCs do not have published MIR values. In these cases, using a methodology developed by Dr. Carter, we are able to calculate upper-limit MIR (ULMIR) values. Our proposals to address uncertainty and the methodology to calculate ULMIR values are discussed in greater detail later in this paper. To further refine the science we are also continuing to fund research.

As the science of reactivity continues to improve we acknowledge that amendments to the proposed regulation will be necessary to reflect new information, such as changes to the base ROG mixture MIR value. In fact, our proposed regulation is based on improved data provided by Dr. Carter on August 6, 1998 (Update, 1998). The MIR values published in Dr. Carter's latest list are in absolute form, such that the units are in grams of ozone formed per gram of VOC emitted. The base ROG mixture MIR is 3.93 g O₃/g VOC, which is less than five percent different compared to the 1997 MIR for the base ROG mixture. The use of absolute MIR values allows us to more simply compute the product's ozone-forming potential.

To help insure that we are utilizing reactivity science appropriately we have also presented our proposals, including use of the MIR scale, to the Reactivity Scientific Advisory Committee (RSAC). The members of RSAC are leading researchers and renowned scientists in the field of atmospheric research.

2. Using the MIR Scale to Establish a Voluntary Compliance Option for Aerosol Coatings

In the Aerosol Coating Regulation, total VOC content is limited on a percent-by-weight basis, without consideration for the differences in VOC reactivity. This approach to controlling VOC emissions from aerosol coatings continues to be effective. However, the science of reactivity now allows us to more effectively control VOC emissions by targeting reductions from VOCs that have a higher potential to form ozone. Using this approach we believe that we can achieve equivalent ozone reductions, as are achieved through compliance with the mass-based regulation. One analysis conducted by Russell, et al. showed that reactivity-based regulation can

be more efficient than the mass-based system (McBride, 1997). To determine the feasibility of a reactivity-based VOC control strategy, in June of 1996, several consumer product manufacturers participated in a pilot project. Results of the pilot project indicated that the performance and efficacy of products could be maintained while producing less reactive products.

Several approaches to establishing a reactivity program were considered. One approach was to establish a solvent-substitution program. In this type of approach a manufacturer would supply an existing mass VOC complying product's formulation and total reactivity. The manufacturer would then provide a proposal to lower the product's reactivity by substituting a less reactive solvent for a higher reactive VOC solvent in the current formulation. The total VOC content could increase as long as the reformulated product's weighted reactivity did not increase.

However, this type of approach would only have merit for existing products. Consumer products or aerosol coatings new to the market or products required to meet future effective VOC limits, would first have to formulate to meet the mass limits before applying to enter this type of reactivity program. This would be cost prohibitive for many manufacturers and raises concerns about ensuring a level playing field. The application and record-keeping process would potentially be burdensome to manufacturers and would likely require extra resources to implement.

To ensure a level playing field for existing and new products, establishing reactivity limits equivalent to the mass-based VOC limits is most appropriate. This provides true flexibility by allowing a manufacturer to choose the compliance option that is most cost-effective.

Because future-effective VOC content limits are being proposed for aerosol coatings, we have the opportunity to establish voluntary reactivity-based VOC limits to provide a compliance option. Manufacturers will be able to choose to comply with either the mass-based limits or the voluntary CLEAR limits. The proposed reactivity limits will achieve equivalent reductions in ozone from aerosol coatings as would be achieved by the proposed mass-based limits. We can establish limits because the necessary speciated data are available from the 1997 aerosol coating survey. Based on these data and using the MIR scale, we can calculate the overall reactivity of a category. This provides the baseline to determine the reductions necessary.

3. Assigning MIR Values to VOCs

The aerosol coating regulation currently contains exemptions for low reactive VOCs, such as acetone, ethane, perchloroethylene, and para-chlorobenzo-tri-fluoride (PCBTF). This regulation essentially uses a reactivity scale of zero and one for non-reactive and reactive VOCs, respectively. This is practical for the implementation of mass-based regulations. However, this approach disregards the differences in VOC reactivities. In contrast to this type of reactivity scale, the MIR scale allows us to distinguish each VOC including acetone, by its characteristic reactivity value. This leads to a more efficient VOC control strategy. The low reactive VOCs do contribute to ozone formation once they are emitted, they are just much less potent. Because of

this, it is technically sound to assign the negligibly and low reactive VOCs their appropriate reactivity values and include them in calculating limits and a product's overall reactivity. In fact the data show that the acetone content in aerosol coatings can change the reactivity of a product by 10 percent or more. This provides evidence that the reactivities of low reactive VOCs should be considered. Therefore, we are proposing to include and account for the reactivity of all VOCs in the CLEAR Regulation. However, we believe the use of these low reactive compounds would not be discouraged in the CLEAR Regulation, because of their corresponding low reactivity values.

4. Uncertainty

There are uncertainties associated with the MIR values estimated for VOCs. Because of this, it is important to evaluate whether the uncertainties need to be addressed for establishing reactivity limits for aerosol coatings.

The most recent table of MIR values, dated August 6, 1998, includes estimated MIR values for approximately 550 VOCs. This listing represents decades' worth of scientific research which has allowed us to better understand VOC photochemistry. A number of VOCs listed were studied extensively in smog chamber experiments to serve as the basis for our Low Emission Vehicle/Clean Fuels (LEV/CF) Program. For these VOCs, the reaction mechanisms and reaction rates have been well-characterized such that their photochemical reactivity can be reliably predicted for purposes of regulatory applications. MIR values for these VOCs are expected to remain stable, and are, in general, the most commonly used VOCs in aerosol coatings.

There are some listed VOCs that have not been studied extensively, while for others, very little data are available. For these VOCs, MIR values are predicted based on expert analysis of available scientific data and photochemical modeling. Because these are estimates, however, there is a degree of uncertainty associated with the published MIR value.

To address uncertainty of VOC MIR values, based on his technical expertise, Dr. Carter provided a numerical ranking to categorize the uncertainty associated with each MIR value. The uncertainty designations are ranked from 1 to 11. These rankings are not intended to be a measure of the magnitude of the uncertainty, but rather are intended to provide useful guidance on the type of uncertainty associated with the MIR value. These rankings are shown in Table 1.

In his report, dated August 6, 1998, Dr. Carter provided recommendations for use of uncertainty factors. Our proposal to address uncertainty is to follow Dr. Carter's recommendations.

TABLE 1: Uncertainty Rankings and Interpretation

Uncertainty Ranking	Interpretation of MIR Value Uncertainty Rankings
1	Considered to be least uncertain.
2	Some uncertainties but not likely to change significantly.
3	Uncertain but not likely to change significantly.
4	Uncertain adjusted mechanism may change somewhat if refined, but change not expected to be large.
5	Uncertain, may change if more studies are conducted or estimation methods are updated. Change in MIR is expected to be less than factor of two.
6	Uncertain, may change if more studies are conducted or estimation methods are updated. Uncertainty adjustments recommended.
7	Uncertain, expected to change if it is studied more or estimation methods are updated. Uncertainty adjustments recommended.
8	Reasonable chance that MIR value significantly incorrect. Uncertainty adjustments recommended.
9	Current mechanism is expected to or has been found to over-predict reactivity.
10	Current mechanism is expected to or has been found to under-predict reactivity. Uncertainty adjustments recommended.
11	Probably incorrect, but biases in atmospheric reactivity predictions are uncertain. Uncertainty adjustments recommended.

In proposing adjustment factors for VOCs, our goal is to have an uncertainty protocol that is straight-forward and easy to apply. The protocol is also intended to be flexible such that as additional VOCs are studied to reduce uncertainty it is simple to be recategorized to a ranking where no adjustment factor is needed.

Proposed Adjustment Factor for Uncertainty Rankings 1 Through 5

We are proposing that an adjustment factor of one be applied to VOCs in uncertainty rankings 1 through 5. The VOCs in categories 1 through 5 have been studied extensively and data are available to indicate that these MIR values are stable. Because of this, we believe it is appropriate to use the MIR values in these rankings without further adjustment for uncertainty. VOCs used in large percentages in aerosol coatings such as dimethyl ether, propane, isopropanol, toluene, xylene, butane, and acetone fall into this category. Although the reactivities of VOCs in category 5, such as higher carbon number alkanes, are not completely understood, there is less

uncertainty relative to the higher categories. The change in the MIR value due to uncertainty is expected to be less than two times.

Proposed Adjustment Factor for Uncertainty Rankings 6, 7, 8, 10 and 11

As shown in Table 1, the MIR values for VOCs in uncertainty rankings 6, 7, 8, 10 and 11 may change as they are studied further and more data become available. However, we can not predict whether the VOC is likely to be found to be more reactive, meaning an increase in the MIR value, or less reactive, meaning a decrease in the MIR value. To ensure that the ozone formation potential of aerosol coatings does not inadvertently increase, we are proposing that all MIR values in these categories be adjusted upward.

We are proposing that for categories 6, 7, 8, 10, and 11, an uncertainty adjustment factor of 2 or the calculated ULMIR, whichever is higher, be applied to each MIR value. This follows Dr. Carter's recommendation. To further evaluate the appropriate adjustment factor, we evaluated the percent change in all published MIR values between 1991 and 1997. This evaluation showed that only a small number of MIR values changed more than two-fold between these years. We have also reviewed scientific literature regarding MIR value uncertainty analyses. In one study that analyzed estimated MIR values to determine their degree of uncertainty, it was found that uncertainties in the reactivities ranged from about 30 percent to about 70 percent of mean estimates (ES&T, 1995). In another paper, for most compounds investigated, MIR value uncertainties ranged from 30 percent to 50 percent of the mean MIR values (Science, 1995). These two studies provide further evidence that a factor of two results in an appropriate a CLEAR Program that is defensible. This proposal is consistent with the recommendation of Dr. Carter.

Proposed Adjustment Factor for Uncertainty Ranking 9

For VOCs in uncertainty category 9, we are proposing that an adjustment factor of 1 be applied. As shown in Table 1, it has been determined through additional research that the reactivity of VOCs in rank 9 has been overpredicted. Hence, the published MIR value would not increase, but rather will likely be reduced if further studied. Using the currently published MIR value will provide the necessary buffer to ensure no ozone disbenefit.

We have evaluated the 1997 aerosol coating survey data and have determined that about 98 percent of the inventory is comprised of VOCs that are well-characterized and fall into rankings 1-5. Because the adjustment factor of 2 would apply to a very small minority of the inventory, there is virtually no impact on overall reactivity. However, the adjustment is necessary to ensure that use of VOCs with uncertain or unknown MIR values would not inadvertently lead to increases in ozone formation.

5. Hydrocarbon Solvent Bins

Hydrocarbon solvents are a diverse product group. Typical hydrocarbon solvents are mineral spirits, also called Stoddard solvent, VM&P naphtha, and naphtha. These solvents are not composed of a single chemical component, but rather many hydrocarbon constituents. They are produced from the fractionation of a broader distillation range petroleum stream. Thus, distillation range, or boiling range, is a primary parameter for characterizing hydrocarbon solvents. Hydrocarbon solvents often contain hydrocarbons that differ both in structure (i.e., paraffin, aromatic, etc.) and in the number of carbon atoms. Composition of hydrocarbon solvents is determined by the type of refining process.

Chemical composition and volatility (i.e., distillation range or carbon number) are key inputs to assigning accurate photochemical reactivity values. Chemical Abstracts Service (CAS) numbers are not suitable for assigning MIR values to hydrocarbon solvents because these numbers are established using only the last refining step and the product's distillation/carbon number range. Hence, compositional differences (e.g., aromatic content) are not defined by these numbers.

Because CAS numbers can not be used to accurately assign MIR values, we are proposing to “bin” hydrocarbons of similar volatility and general composition and assign an MIR value to each bin. Characteristics we have considered in proposing these bins include boiling range, aromatic content, and paraffin content (for products greater than 70 percent alkane). Our proposal is shown in Table 2. In general, the hydrocarbon solvents that fall into these proposed bins generally would meet this definition:

Aliphatic hydrocarbon solvents are predominantly saturated hydrocarbons that contain no more than 25 weight percent aromatics and 2 weight percent olefins. Cycloparaffinnic content is limited to less than 70 weight percent of the total hydrocarbon and normal paraffins are limited to less than 30 weight percent of the total hydrocarbon. Note that we are proposing to establish separate bins for hydrocarbon solvents with compositions of greater than 90 percent isoalkanes, cycloalkanes, or normal alkanes. Separate bins are also proposed for aromatic hydrocarbon solvents. Also note that some hydrocarbon solvents will be assigned specific MIR values (such as hexane) and will not be binned.

Boiling range is a key property of hydrocarbon solvents. Because each hydrocarbon constituent of the solvent boils at a specific temperature, we can use this to determine the carbon number of the hydrocarbons present. For example alkanes of six or seven carbons boil at lower temperatures ($\approx 100\text{-}240^\circ\text{F}$) than would alkanes of eight or nine carbon length ($\approx 240\text{-}310^\circ\text{F}$).

It is also important to consider aromatic content, because, in general, these types of compounds are most reactive. As an example, normal heptane, and the aromatic VOC toluene,

both have seven carbon atoms. However, toluene is almost three times more reactive than normal heptane.

Our other criterion for establishing bins, paraffin (alkane) content is important because the structure of alkanes also contributes to reactivity. For example, alkanes may contain the same number of carbon atoms, but if the carbons are branched rather than a straight chain, the alkane is more reactive. The cyclic alkanes are, in general, even more reactive than the branched alkanes. As an example, the MIR values for normal (straight chain), isoalkanes (branched alkanes), and cycloalkanes each with six carbon atom are 1.69, 1.76, and 1.96 respectively.

To estimate MIR values for each bin we relied upon compositional data supplied by raw material suppliers. Using these data we are able to establish a composite weighted MIR value for hydrocarbon solvents with similar properties.

We are proposing that in any bin, an aromatic content of two percent or less would be considered to contain no aromatics. Hence, the MIR value for solvents with less than 2 percent aromatics would be based solely on the product's alkane content and boiling range. For solvents containing both aromatics and alkanes, bins established by boiling range would be subdivided based on aromatic content (at increments of 5 percent). The aromatic content with each "sub-bin" is assumed to be the highest percent within the range specified for that bin. For example, a sub-bin of 5 percent to less than 10 percent would be assumed to contain 10 percent aromatics and this value would be used to calculate the aromatic content MIR.

To arrive at the total MIR of each bin, the MIR of the aromatic fraction is added to the MIR of the alkane content to obtain the total weighted MIR. The MIR values for each proposed bin is included in the Table of Specific MIR values in the CLEAR Regulation section 94533(d). We are also proposing that no further uncertainty adjustment factor be added to the MIR value for each bin. This is consistent with the recommendations of Dr. Carter. The proposed bins are as follows:

- Proposed 'Bin 1', boiling range 100-240°F, includes solvents with constituent hydrocarbons with typically 6 or 7 number of carbons.
- Proposed 'Bin 2', boiling range 240-310°F, includes solvents with constituent hydrocarbons with typically 8 or 9 number of carbons.
- Proposed 'Bin 3', boiling range 310-415°F, includes solvents with constituent hydrocarbons with typically 9, 10, 11, or 12 number of carbons.
- Proposed 'Bin 4', boiling range 415-600°F, includes solvents with constituent hydrocarbons with more than 12 number of carbons.

Any changes to the MIR value for any hydrocarbon solvent bin would be proposed through a full public process. To assist manufacturers and formulators to select the appropriate solvent based on its MIR value, raw material suppliers have voluntarily agreed to include Bin assignments on their product information sheets for hydrocarbon solvents.

**TABLE 2: PROPOSED DRAFT APPROACH FOR ASSIGNING
MIR VALUES TO HYDROCARBON SOLVENTS***

<u>Bin</u>	<u>Boiling Range (degrees F)</u>	<u>Aromatic Content</u>	<u>Total MIR</u>
Bin 1	100-240	0% to less than 2%	1.8
Bin 1A	100-240	2% to less than 5%	1.9
Bin 1B	100-240	5% to less than 10%	2.0
Bin 1C	100-240	10% to less than 15%	2.2
Bin 1D	100-240	15% to less than 20%	2.3
Bin 1E	100-240	20% to less than 25%	2.4
Bin 1F	100-240	greater than 90% normal alkanes	1.6
Bin 1G	100-240	greater than 90% cycloalkanes	2.4
Bin 1H	100-240	greater than 90% isoalkanes	2.3
Bin 2	240-310	0% to less than 2%	1.7
Bin 2A	240-310	2% to less than 5%	2.0
Bin 2B	240-310	5% to less than 10%	2.3
Bin 2C	240-310	10% to less than 15%	2.6
Bin 2D	240-310	greater than 90% normal alkanes	1.3
Bin 2E	240-310	greater than 90% cycloalkanes	1.9
Bin 2F	240-310	greater than 90% isoalkanes	1.8
Bin 3	310-415	0% to less than 2%	1.1
Bin 3A	310-415	2% to less than 5%	1.4
Bin 3B	310-415	5% to less than 10%	1.7
Bin 3C	310-415	10% to less than 15%	1.9
Bin 3D	310-415	15% to less than 20%	2.2
Bin 3E	310-415	20% to less than 25%	2.5
Bin 3F	310-415	greater than 90% normal alkanes	0.8
Bin 3G	310-415	greater than 90% cycloalkanes	1.4
Bin 3H	310-415	greater than 90% isoalkanes	1.2
Bin 4	415-600	0% to less than 2%	0.9
Bin 4A	415-600	2% to less than 5%	1.2
Bin 4B	415-600	5% to less than 10%	1.4
Bin 4C	415-600	10% to less than 15%	1.7
Bin 4D	415-600	greater than 90% normal alkanes	0.6
Bin 4E	415-600	greater than 90% cycloalkanes	0.9
Bin 4F	415-600	greater than 90% isoalkanes	0.9
Bin 5A	300-355	Aromatics	7.0
Bin 5B	355-420	Aromatics	6.8
Bin 5C	420-550	Aromatics	6.0

* Please note that these proposed bins do not represent all hydrocarbon solvents. Some compounds will be named in the Table of MIR Values and will have a specific value assigned.

6. Upper Limit MIR Calculations

We are proposing to use the Upper-Limit MIR methodology, as developed by Dr. Carter, to calculate the ULMIR for VOCs that do not have published MIR values. This methodology is a simplified model based on the MIR scale. The basic framework, except for the latest August 6, 1998, update, has undergone peer review by the RSAC. The Upper-Limit MIR methodology is based on empirical results of tested VOCs and reflects our best of knowledge on the accuracy of the science of incremental reactivity.

For the calculation of the ULMIRS the upper-limit kinetic reactivity is multiplied by its mechanistic reactivity (Carter, 1997; Update, 1998). The kinetic reactivity is the fraction of emitted VOC which reacts during the episode. The mechanistic reactivity is the amount of ozone formed per molecule of VOC reacted. For the purposes of the calculation for ULMIRs, the mechanistic reactivity is the minimum of the VOC's photo-degradability; the function of the number of carbons in the VOC; the function of the VOC-OH reaction rate constant and class of VOC; or 32 or 35 depending upon photo-degradability.

Each ULMIR would be calculated based on the equations shown in Figure 1. Because an ULMIR infers the highest reactivity for a given VOC, we are proposing that no additional uncertainty adjustment factor be applied to any calculated ULMIR. Each ULMIR calculated will be included in the Table of Specific MIR Values in proposed section 94533(d) in the CLEAR Regulation.

Figure 1: Calculation of Upper Limit MIRs (ULMIRs)

To calculate the ULMIR for a VOC for which an MIR value is not available, the following equations are used:

ULMIR = Kinetic reactivity X Mechanistic Reactivity,

where:

ULMIR is in units of g O₃ formed/ g VOC emitted,

Kinetic reactivity is the fraction of VOC reacting (unitless), and

Mechanistic reactivity is g O₃ formed/ g VOC reacting.

$$\begin{aligned}\text{Kinetic Reactivity} &= 1 - \exp(-\text{Integrated Reaction Rate}) \\ &= 1 - \exp(-\text{effective kOH} \times \text{EffIntOH})\end{aligned}$$

Where the Integrated Reaction Rate takes into account VOC photolysis and reactions with O₃ and OH and NO₃ radicals, and can be represented by the product of effective kOH rate constant and EffIntOH, which is the effective integrated OH radical levels

To calculate MIR Kinetic Reactivity (KR):

- ▶ If effective kOH not known, use maximum of 1;
- ▶ If kOH is estimated, increase estimated kOH by factor of 2.

To calculate MIR Mechanistic Reactivity (MR):

- a) For Photoreactive compounds, use minimum of:
 - ▶ 35; or
 - ▶ 11 times number of carbons.
- b) For Alkanes, Alcohols, Ethers, Glycols, Glycol Ethers, use minimum of :
 - ▶ 32
 - ▶ 6 times number of carbons; or
 - ▶ $26.9 - 14.8 \times \exp(3.3 \times 10^{10} \times \text{kOH})$
- c) For Esters, Ester Alcohols, Ester Ethers, use minimum of:
 - ▶ 32
 - ▶ 6 times number of carbons; or
 - ▶ $37.9 - 21.6 \times \exp(-3.2 \times 10^{10} \times \text{kOH})$
- d) For all other VOCs, use minimum of:
 - ▶ 32; or
 - ▶ 6 times number of carbons.

7. Proposed Methodologies to Calculate CLEAR Limits

We are proposing two approaches to establish CLEAR Limits. In general, the method chosen to calculate a limit for a given aerosol coating category is related to the number of products that are currently able to comply with the proposed mass-based limits. In instances where not all products comply with the mass limits we propose to use the “percent reduction” approach. In other specialty categories where the complying marketshare is 100 percent, we are proposing to use the “complying products approach.” Both of these methodologies will result in a limit equivalent to the proposed mass-based limit. These two methodologies are explained below. It should be noted that these two methodologies are appropriate for establishing voluntary CLEAR limits for aerosol coatings, but may not be applicable to other source categories.

Percent Reduction Method

The percent reduction is proposed as the method to calculate CLEAR limits when not all products are able to comply with the proposed mass-based VOC limit. To calculate a CLEAR limit using this method, step one is to determine the percent reduction in mass. For example, if the sales weighted average (SWA) VOC content is 60 percent for a category, and the proposed limit is 45 percent, the percent reduction in mass is 25 percent. This same percentage (25), is then applied to the SWA MIR of all products in the category. Hence the CLEAR limit would be set at a reactivity that is 25 percent less than the SWA MIR content. We believe this approach is appropriate because the products that are able to comply with the mass-based limit may not be representative of all products in the category. Hence, using the SWA MIR of the complying products is not appropriate.

We are proposing to use the percent reduction method for the following categories:

Flat Paints	Art Fixatives and Sealants
Nonflat Paints	Auto Body Primers
Fluorescent Coatings	Marine Spar Finish
Metallic Coatings	Spatter/Multicolor Coatings
Clear Coatings	Vinyl/Fabric/Leather/Polycarbonate
Primers	Weld-thru Primers
Floral Sprays	Ground Traffic/Marking Coatings
Photographic Coatings	Glass Coatings
Hobby/Model/Craft Coatings - Enamel, Lacquer, Clear or Metallic	
Wood Touch-up, Repair or Restoration Coatings	
Automotive Bumper and Trim Products	
Exact Match Finishes - Engine Enamel, Automotive, and Industrial	
Corrosion Resistant Brass, Bronze, or Copper Coatings	

Complying Products Method

For the other specialty categories of aerosol coatings, we are proposing to use the “complying products” method. In these coating categories all products are able to comply with the proposed mass-based VOC limits. Hence, the percent reduction method can not be used. Using this method, the CLEAR limit becomes the SWA MIR of all the products.

Aviation or Marine Primers
Aviation Propellor Coatings
Wood Stains
Webbing/Veil Coatings
Slip-Resistant Coatings
Pleasure Craft Topcoats
Pleasure Craft Finish Primers, Surfacer or Undercoaters
Shellac Sealers - Clear and Pigmented

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